Michigan Department of Labor & Economic Growth
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Bureau of Construction Codes
Technical Bulletin

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Roof Design

"Providing for Michigan's Safety in the Built Environment"

Technical bulletins are issued to provide clarification on issues which arise regarding code administration and enforcement. The information provided in the bulletin is developed to promote uniform interpretation and enforcement of the state codes.

ROOF DESIGN

Issue

With the adoption of the Michigan Building Code (MBC) and Michigan Residential Code (MRC) in 2001, several questions have been raised regarding the application of the code provisions relating to roof snow loads.

In previous editions of the codes in effect in Michigan, the codes set forth specific requirements for roof loading. However, with the adoption of the MRC, some confusion has been raised regarding the methodology of determining roof loads for one- and two-family dwellings regulated by the MRC. In a number of instances, the design of roof truss systems has not reflected the dynamics of the site at which the system is installed. The MBC requires consideration for such items as exposure, thermal factors, and importance factors. While the MRC does not specifically identify these items as design considerations, the code requires compliance in engineered systems with accepted engineering practices.

To clarify this situation, responses to two questions are posed to offer clarification and guidance in the application of the Michigan Building Code and the Michigan Residential Code. The first question involves the application of loading criteria for snow loads. The second involves exposure factors.

It is the intent of this Technical Bulletin to provide guidance in the application of the code and to provide a means for local code officials to review the design to determine compliance with the applicable code provisions.

Discussion

The Michigan Building Code references ASCE 7 – 98, Minimum Design Loads for Buildings and Other Structures, to determine the applicable loading criteria for roof structures. Section 1608.2 of the code provides for ground snow loads.

The Michigan Residential Code, while not directly referencing ASCE 7, can be interpreted that the standards for truss designs are based upon the criteria contained in this document. Section R801.2 of the MRC provides:

> "Roof and ceiling construction shall be capable of accommodating all loads imposed according to Section R301 and of transmitting the resulting loads to the supporting structural elements."

Section R802.2 provides:

> "Roof-ceilings shall be designed and constructed in accordance with the provisions of this chapter and Figures R606.10(1), R606.10(2) and R606.10(3) or

in accordance with AFPA/NDS. Components of roof–ceilings shall be fastened in accordance with Table R602.3(1)."

Truss design drawings are required to be prepared in conformance with the code and provided to the code official as provided by Section R802.10.1. This section of the code requires a truss design to include specific information including: Slope and depth, span and spacing; location of all joints; required bearing widths; design loads as applicable, adjustments to lumber and joint connector design values for conditions of use; reaction force and direction; joint connector type and description; lumber size, species and grade; connection requirements for truss to truss girder, truss ply to ply, field splices; calculated deflection ratio and /or maximum description for live and total load; maximum axial compression forces; and required permanent truss member bracing location. These items are similar to design criteria provided in ASCE 7 and it can be concluded that the design methodology for residential and nonresidential applications are the same.

The criteria provided in ASCE 7 for exposure factors, are more site specific than in earlier editions of the standard. Again, the MRC requires the documentation of this information, similar to the provisions of ASCE 7. This information is necessary for truss designers to meet the design criteria required by the code. It is the permit applicant's responsibility to provide this information on all design documents submitted to the enforcing agency. This may include the builder, design professional or the homeowner.

Conclusion

The Michigan Residential Code provides for standards for truss designs and requires documentation similar to ASCE 7. Also, the MRC, like ASCE 7, requires documentation of exposure factors relating to the specific building site.

The design of roof structures includes several components. To assist in the development of appropriate design criteria and in the evaluation of the criteria, the attached **Roof Loading Data Sheet** is provided. This data sheet may be submitted at the time of application to provide the ground snow load, P_g; the exposure factor, C_e; the thermal factor, C_t; and the importance factor, I.

The data sheet is a tool to assist in the application of the requirements of the code. The applicant familiar with the site conditions may be the most appropriate person to complete the data sheet along with input from the designer of the roof system.

Questions regarding this technical bulletin may be directed to the Michigan Department of Labor & Economic Growth, Bureau of Construction Codes, Building Division, P.O. Box 30254, Lansing, MI 48909 or by calling (517) 241-9317.

Attachment: Roof Loading Data Sheet

Roof Loading Data Sheet

Authority: Act 230 PA 1972, as amended Completion: Completed prior to application for plan review and building permit. This form is a voluntary form used to assist in the permit approval process.	Jurisdictional information should be included in this space

Applicant's Name:		Date:
Applicant's Address:		Permit Number:
City:	State:	Zip:
Applicant's Signature:		
Job Location:		
Address:		
Township/Village/City:		County:

THIS FORM SHOULD BE COMPLETED BY THE PERMIT APPLICANT, OR DESIGN PROFESSIONAL

FOR C_e, C_t, AND I, PLACE AN "X" IN THE APPROPRIATE BOX THAT BEST DESCRIBES THE STRUCTURE.

Ground Exposure, P_g = _____ From Figure R301.2(5) MRC or Figure 1608.2 MBC

Exposure Factor C_e

	Exposure	Fully Exposed[1]		Partially Exposed[2]		Sheltered[3]	
A	Large city center with at least 1/2 the buildings exceeding 70 ft. in height.	N/A		1.1		1.3	
B	Urban and suburban areas, wooded areas or other terrain with closely spaced objects having the size of single-family dwellings or larger.	0.9		1		1.2	
C	Open terrain with scattered obstructions having heights less than 30 ft. (flat open country)	0.9		1		N/A	
D	Flat unobstructed areas exposed to wind flowing over open water for a distance of at least 1 mile. (i.e. Great Lakes.)	0.8		0.9		N/A	

[1]Fully Exposed: Roofs exposed on all sides with no shelter by terrain, higher structures, or trees.

[2]Partially Exposed: All roofs except those designated as "fully exposed" or "sheltered."

[3]Sheltered: Roofs located tight among conifers that qualify as obstructions.

Thermal Factor C_t

Thermal Condition[4]	C_t	
All structures except as listed below	1	
Structures kept just above freezing and those with cold, ventilated roofs with an R factor of 25 or greater between the ventilated and heated spaces, such as attics	1.1	
Unheated structures and those intentionally kept below freezing, such as seasonal building or storage buildings	1.2	
Continuously heated greenhouse with a roof R Value less than 2 and having an interior temperature maintained at about 50 degrees 3 ft above the floor during winter months and a temperature alarm system or an attendant to warn of a heating failure.	0.85	

[4]These conditions shall be representative of the anticipated conditions during winter months for the life of the structure

Importance Factor

Category		I	
I	Building and other structures representing low hazard to human life, i.e.: Agricultural, Temporary, and Minor Storage Facilities.	0.8	
II	All buildings except those listed in Categories III and IV.	1	
III	Building and other structures representing substantial hazard to human life in the event of failure.	1.1	
IV	Buildings and other structures designated as essential facilities.	1.2	

Attic Live Load

Entire Attic	Y/N
Specific Areas (if yes, list areas below)	Y/N
List Rooms:	